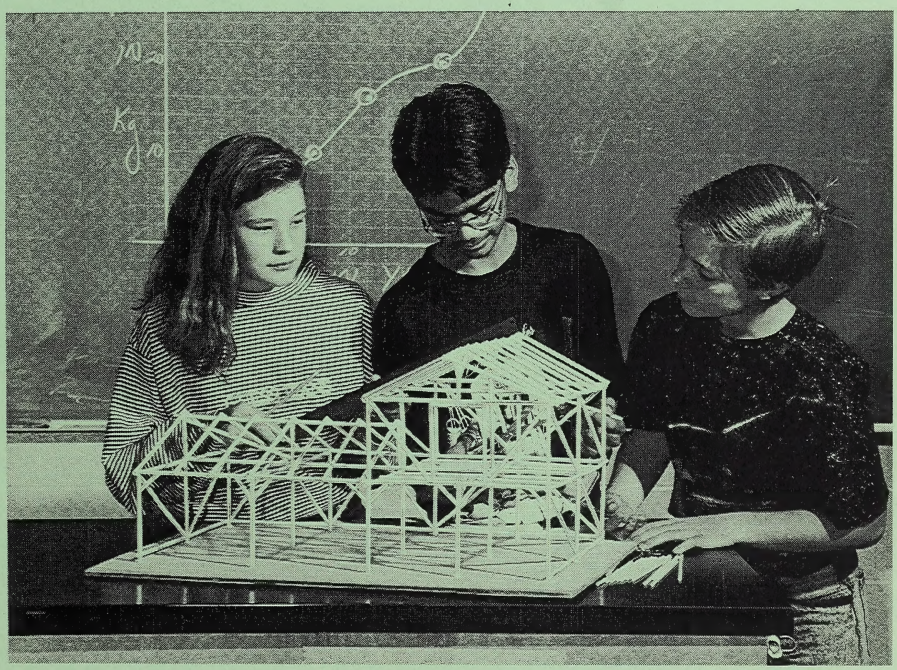
Assessment Highlights

Grade 6 Science



June 1994

Students First!

Student Evaluation

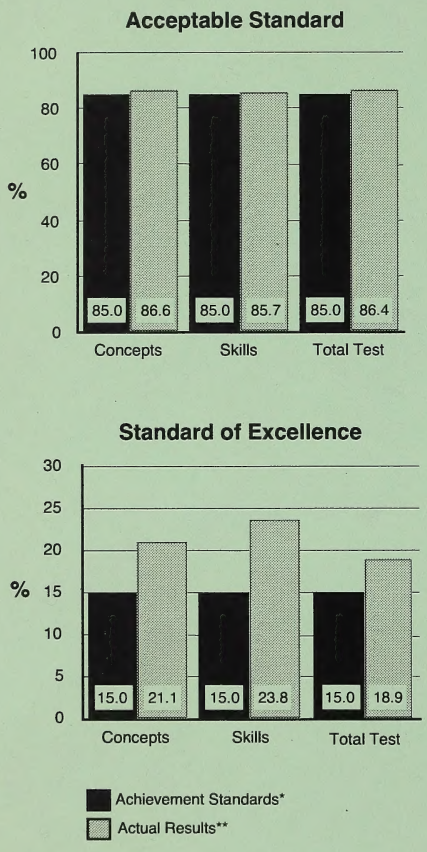
Alberta EDUCATION

Assessment Highlights

Grade 6 Science

This report provides teachers, school administrators, and the public with an overview of the results for the June 1994 Grade 6 Science provincial assessment. It complements the detailed school and jurisdiction reports.

Percentage of Students Meeting:



*the percentage of students in the province expected to meet the acceptable standard and the standard of excellence

**the percentage of students in the province who met the standards

Who Wrote the Test?

All students registered in Grade 6 were expected to write the 1994 Science Achievement Test. A total of 39 127 students completed the June 1994 test. This number reflects an increase of more than 4000 students over last year due to administration policy change.

What Was the Test Like?

The assessment instrument had 60 multiple-choice questions in three topic areas: Matter and Energy, Living Things and the Environment, and Earth, Space, and Time. Two learning domains were assessed: Concepts (21 questions) and Process Skills (39 questions). Students recorded their responses to questions on a separate answer sheet.

How Well Did Students Do?

The results presented in this report are based on scores achieved by all students except those in Francophone programs. Results for Francophone students will be reported separately. As shown by the graphs, the number of students meeting the acceptable standard and the standard of excellence was higher than expected. This is especially impressive given that a higher proportion of Grade 6 students than ever wrote the test.

Has Achievement Changed Since 1982?

A special study of changes in achievement was conducted as part of the provincial assessment. Results suggest that science achievement in 1994 is slightly higher than in 1982, 1986, and 1990.

Test Blueprint

Each question on the blueprint is classified according to its assessment component and learning domain. The blueprint shows the distribution of questions according to these classifications.

Topic	Percent of Course and Number of Questions	Percent Emphasis and Number of Questions	
		Learning Domain	
		Concepts	Skills
1. Matter and Energy	45 (27)	15 (9)	30 (18)
2. Living Things and Environment	35 (21)	13 (8)	22 (13)
3. Earth, Space, and Time	20 (12)	7 (4)	13 (8)
Total	100 (60)	35 (21)	65 (39)

Test Results

The table below shows keyed answers and question-by-question results achieved by students who wrote the regular form of the test.

Individual Multiple-Choice Questions

Question	Key	Difficulty*	Question	Key	Difficulty	Question	Key	Difficulty
1	D	72.2	21	A	83.9	41	D	89.0
2	A	66.5	22	D	67.9	42	C	66.5
3	D	85.8	23	D	54.7	43	B	55.5
4	C	72.6	24	A	71.0	44	A	68.6
5	A	60.7	25	C	82.3	45	C	66.2
6	C	75.1	26	A	83.2	46	D	69.6
7	C	33.5	27	A	71.2	47	D	73.8
8	B	63.9	28	B	81.3	48	D	68.7
9	A	71.3	29	B	61.4	49	B	66.6
10	C	53.4	30	D	40.8	50	D	80.4
11	B	47.9	31	D	64.2	51	B	75.1
12	B	63.0	32	D	80.9	52	B	60.1
13	A	75.5	33	C	90.2	53	B	64.3
14	A	74.4	34	B	74.2	54	A	70.9
15	A	89.4	35	D	50.2	55	C	88.9
16	B	86.1	36	C	81.1	56	B	45.3
17	C	86.9	37	D	61.4	57	D	36.6
18	C	72.0	38	D	66.6	58	B	61.9
19	A	75.6	39	B	61.6	59	D	74.2
20	B	62.9	40	D	79.3	60	C	77.3

*Difficulty—percentage of students answering the question correctly.

Test Review

The Grade 6 teachers who reviewed and set standards for the assessment felt that it adequately covered both concepts and process skills in all three units and that it was a good reflection of the science program. The majority of the teachers appreciated "real-life situations" presented in the vignettes and generally felt that the pictures were important for the visual student and enhanced comprehension for all students. The group also encouraged continued improvement of the graphics and pictures. They also felt that the assessment had a good range of question types and difficulties that were representative of the science program.

Use the following information to answer question 10.

That night, everyone sat around the campfire. While Rita was looking through her binoculars, she noticed a particularly bright star. She looked in her astronomy book and found this chart.

Name of Star	Brightness	Distance from Earth (light years)
Beta Cassiopeiae	2	45
Delta Aquarii	3	84
Epsilon Andromedae	4	105
Fomalhaut	1	23

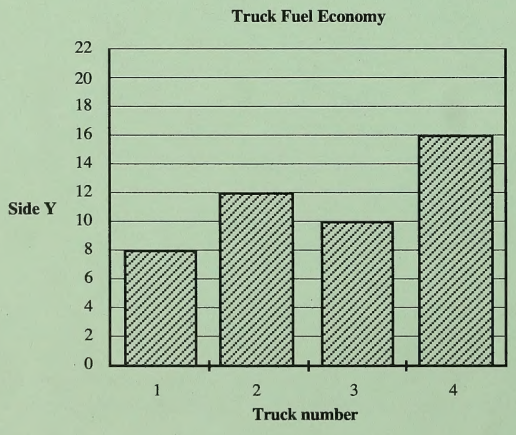
Brightness: 1=very bright
4=very dull

10. From this chart, Rita interpreted correctly that brightness

8.2 **A.** is not affected by distance
31.2 **B.** increases as distance increases
53.4 ***C.** decreases as distance increases
7.1 **D.** remains the same as distance decreases

Use the following information to answer question 11.

To find a way to save money and fuel, Sally kept track of how far four different delivery trucks on the same route could travel on one litre of fuel. Truck 1 went 8 km, truck 2 went 12 km, truck 3 went 10 km, and truck 4 went 16 km. Sally made this graph to show her findings.



11. Sally couldn't decide which unit to use for **side Y**. Tom said that the correct unit is

8.5 **A.** L/100 km
47.9 ***B.** km/L
10.3 **C.** km/100 L
33.0 **D.** L/km

Observations and Sample Questions

Sample questions from the test and accompanying discussion are provided to highlight the strengths and weaknesses of students meeting the acceptable standard and the standard of excellence. For each sample question, there is an asterisk beside the correct answer. The percentage of students choosing each alternative is also provided.

Acceptable Standard

For **question 10,** only 58% of the students meeting the *acceptable standard* could interpret the inverse relationship between distance and light intensity from a chart.

For **question 11,** only about half of the students meeting the *acceptable standard* could select the measurement unit that would be used on the side of the graph.

For **question 36,** students were required to infer from a diagram the effect of wind and moisture on plant growth. Nearly 9 out of 10 students achieving the *acceptable standard* can do this.

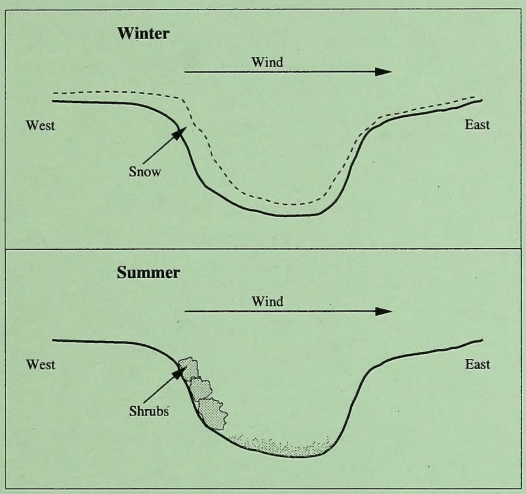
For **question 59,** students had to interpret data on a chart to find the agricultural activity that most affects owl populations. Over 8 out of 10 students meeting the *acceptable standard* could do this.

Overall, results show that students who met the *acceptable standard* were able to

- make inferences from data presented
- solve routine problems
- make observations from a graph
- identify adaptations
- recognize simple open and closed circuits
- understand the concept of reflection
- identify renewable and non-renewable energy sources
- understand the scientific process for experimentation

Use the following information to answer question 36.

Joyce picked up a pamphlet with sketches showing a cross section of a valley in different seasons. This information helped her to understand why shrubs grow only in certain places.



36. In this situation, shrubs grow only on the west side of the valley because that side of the valley has

7.1 **A.** more plant-eating animals and more winds
5.6 **B.** fewer plant-eating animals and more disease
81.1 ***C.** more moisture and less wind
6.1 **D.** less disease and less moisture

Use the following information to answer question 59.

While hiking in southern Alberta, Samuel talked to a farmer who told him about burrowing owls. The farmer had a record of his farming activities and the number of owls that he had observed in certain years.

Farming Activities Near Owl Homes	Years	Number of Owls
haying twice each summer	1985–87	10
grazing cattle in the fall	1987–89	9
planting crops every year	1989–91	7
spraying crops three times each year	1991–93	2

59. Which activity seemed to result in the greatest **decrease** of the number of burrowing owls?

11.8 **A.** Haying twice each summer
5.0 **B.** Grazing cattle in the fall
8.5 **C.** Planting crops every year
74.2 ***D.** Spraying crops three times each year

- identify food webs and food chains
- understand life cycles
- identify physical characteristics of matter

Many of these students, however, did not do as well in

- making interpretations from a graph
- predicting the path of a light beam as it is refracted
- calculating units for graphs
- making specific observations
- making inferences about chemical changes
- recognizing earth changes that take place over a long period of time
- interpreting data from a chart and selecting a graph to represent that data
- predicting electrical flow in a circuit
- determining controlled variables

Standard of Excellence

The following commentary highlights the skills and knowledge of students who met the *standard of excellence.*

For **question 5,** students had to infer that a merganser is a meat eater from observing the teeth on its bill. Over 7 of 10 students meeting the *standard of excellence* can do this.

For **question 35,** students had to select a graph that represents data presented in a chart form. Almost 8 out of 10 students meeting the *standard of excellence* can do this.

For **question 7,** students had to predict the path of a refracted light beam passing from water into air. Only 54% of the students meeting the *standard of excellence* were successful.

For **question 47,** students had to be able to determine the controlled variable in an experiment designed to investigate the feeding habits of spiders. Almost 90% of the students meeting the *standard of excellence* were successful.

Use the following information to answer question 5.

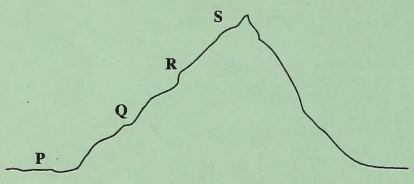
They stopped by a lake. Through his binoculars, Mike saw a merganser. He found pictures of it in his bird identification book. Rita asked Mike about the type of food that the merganser eats.

5. Mike said that based on these pictures, the merganser is **likely**

60.7 ***A.** a meat eater
12.3 **B.** a plant eater
24.1 **C.** an insect eater
2.8 **D.** a grain eater

Use the following information to answer question 35.

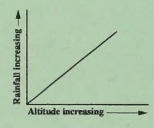
This chart from the nature centre gives information about rainfall on a nearby mountain.



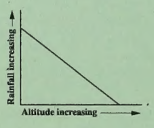
Location	Rainfall (cm per year)
P	38
Q	37
R	37
S	61

35. Which graph shows the data in the chart?

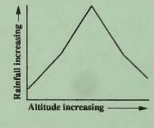
12.4 **A.**



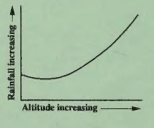
4.9 **B.**



32.2 **C.**



50.2* **D.**



Students who met the *standard of excellence* demonstrated more success than did other students when answering questions that required applying science concepts in novel or new contexts, identifying variables, and interpreting data. Specifically, students meeting this standard could

- transfer and apply knowledge
- look at problems from a number of viewpoints
- analyze patterns
- interpret, analyze, and accurately apply information from charts and graphs
- make accurate inferences from data
- apply information to new situations
- distinguish between behavioral, functional, and structural adaptations
- extrapolate from data presented in chart or graph form

Students meeting this standard did not do as well in

- making accurate inferences from observations
- understanding the concept of refraction
- identifying an inverse relationship from data
- selecting a unit for a graph from information presented
- understanding the concept of condensation

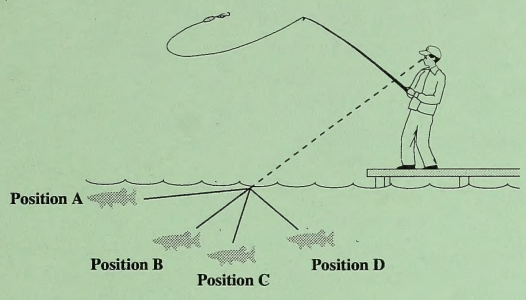
Performance-Based Assessment

In addition to writing the Grade 6 Science Achievement Test, 661 Grade 6 students from across the province participated in a performance-based assessment.

These students were asked to solve six real-life problems and were given concrete materials and/or information to solve these problems. Each problem-solving activity assessed student performance in one of the following task areas: using scientific inquiry methods to solve a problem, constructing a device to solve a practical problem, and observing characteristics of the environment and inferring interactions and relationships.

Use the following information to answer question 7.

When Mike went fishing that afternoon, he saw a fish near the pier.

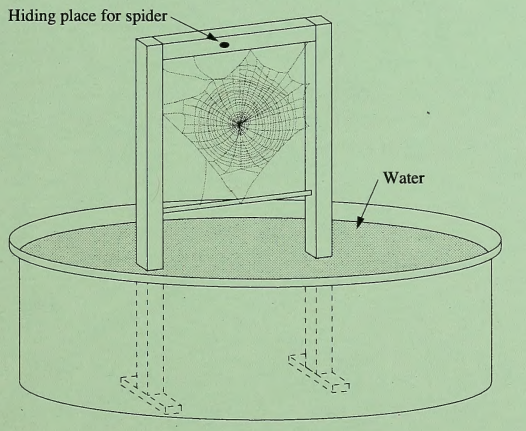


7. He knew that the actual position of that fish was

16.2 **A.** position A
43.6 **B.** position B
33.5 ***C.** position C
6.5 **D.** position D

Use the following information to answer question 47.

Nadia wanted to know if spiders would help to reduce the number of flying insects in a room. She did a study on how many insects a spider caught in a week.



47. Why did Nadia have the frame in a pan of water?

13.3 **A.** To capture insects
3.8 **B.** To provide drinking water for the spider
8.9 **C.** To keep the stand upright
73.8 ***D.** To prevent the spider from escaping

Markers used holistic scales to rate student responses for problem solving and communication. The following charts show the Performance-Based Assessment standards and the percentage of students meeting those standards.

Assessment Standards

Standard	Problem Solving Skills	Communication Skills
Acceptable	9/18	9/18
Excellent	15/18	15/18

Percentage of Students Who Met or Exceeded Standards on the Six Activities

Standard	Problem Solving Skills	Communication Skills
Acceptable	73%	62%
Excellent	9%	7%

The results show that students could

- solve problems using scientific inquiry skills
- make simple observations and inferences
- use a variety of strategies and select materials needed to solve a problem
- account for the manipulated variable and responding variable in an experiment
- use diagrams to accurately communicate information

The results also show that students found it difficult to

- make inferences based on detailed observations
- distinguish between observations and inferences
- identify and communicate the relationships found in a set of data or observations
- use mathematical skills for solving two-step problems

Performance-based assessment will continue to be a component of future assessments.

Questionnaire—Context for Learning

In June 1994, a sample of Grade 6 Science teachers and students from all parts of the province completed "Context for Learning" questionnaires. The purpose of the questionnaire was to collect information and report on the various contexts for learning.

On the student questionnaires, the majority of students reported that

- they believe they are doing well in science but considerably fewer of them believe that others (peers, teachers, parents) perceive them as doing well in science
- they enjoy school, are keen to learn new things, and generally have a positive attitude toward science
- they see the importance of doing well in science and feel it will help them in the future
- their interest in science does not carry over outside of school; it seems to be limited to in-school activities

On the teacher questionnaires, a majority of teachers reported that

- their students demonstrate a positive attitude toward science
- they use a variety of instructional groupings in their science classes but spend less time having students work independently than in other groupings
- the inquiry model is used on a limited basis
- computers and calculators are not an integral part of the science program
- textbooks are used less than a variety of other reading materials
- they use journals or learning logs in at least part of their program
- science is integrated with other subjects to at least some extent
- they may be using a variety of instructional materials and strategies but students are not usually the ones making the choices—the teacher generally decides what should be taught and how it should be taught
- students have a minimal role in their own assessment
- learner expectations are communicated before instruction and teachers provide students with feedback about their success most of the time
- teachers use their assessment results for a variety of purposes
- a very small percentage of parents are involved in the school program in any way

Issues

Information collected from achievement tests and performance-based assessments indicates that, although many students were accomplished in using scientific inquiry skills when responding to multiple-choice questions, many students were not able to use these skills effectively when solving practical problems.

Results from the teacher questionnaire suggest that students are receiving "hands-on" experiences in the program; however, results from the performance-based assessment suggest that students need more opportunities to develop their abilities to construct devices, to solve practical problems, and to investigate issues from a variety of perspectives.

For further information, contact Greg Thomas, Assessment Specialist, at 403-427-0010.

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